Original Article

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Neonatology Section

Study of the Morbidity and the Mortality Patterns in the Neonatal Intensive Care Unit at a Tertiary Care teaching Hospital in Rohtas District, Bihar, India

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ABSTRACT

Objective: To study the morbidity and the mortality patterns in the neonatal intensive care unit at a tertiary care teaching hospital in the Rohtas district of Bihar.

Design: Retrospective study. The medical records of all the neonates who were admitted to the NICU were reviewed.

Settings: Neonatal Intensive Care Unit of a tertiary care teaching hospital which is located in the Rohtas district of Bihar. The study was carried out over a period of 1 year during January 2010 to December 2010.

Participants: 236 neonates with some illness who were admitted to the NICU, who belonged to the Rohtas district of Bihar.

Outcome: The patterns of the morbidity and the mortality among the neonates who were admitted to the NICU in the Rohtas district. 'Survival' was defined as the discharge of a live neonate/ infant from the hospital.

Results: A total of 285 babies were admitted to our NICU, of which 258 babies belonged to the Rohtas district. Of the 258 babies, 22 babies had left the hospital against medical advice (LAMA). A total of 236 neonates were included for the data analysis. The ratio of the male (59.6%) and female (40.4%) Neonates was 1.48:1. The major causes of the morbidity were low birth weight (LBW) (39.8%), prematurity (38.6%), neonatal sepsis (23.3%), neonatal hyperbilirubinaemia (20.4%), birth asphyxia with hypoxic ischaemic encephalopathy (HIE) (18.2 %), intrauterine growth retardation (IUGR) (14 %) and hyaline membrane disease (9.7 %). The most common causes of the referral from other hospitals were severe birth asphyxia with HIE (32.5%), neonatal sepsis (22.9%), prematurity with low birth weight (13.4 %), and prematurity with respiratory distress syndrome (12%). In this study, the overall NICU mortality rate was 13.6% (32/236). The babies who were born outside our hospital had a 2.5 times higher mortality rate as compared to the babies who were born in our hospital. Most of the deaths were associated with low birth weight (including LBW, VLBW and ELBW) (59.2%), prematurity (46.9%), sepsis (34.4 %), hypoxic ischaemic encephalopathy (HIE) (31%), Hyaline membrane disease or Respiratory distress syndrome (RDS) (25%) and intra uterine growth retardation (IUGR) (12.5%).

Conclusion: This study identified LBW, prematurity, neonatal sepsis, neonatal hyperbilirubinaemia, and HIE as the major causes of the morbidity and low birth weight, prematurity, neonatal sepsis, HIE, and Hyaline membrane diseaseor Respiratory distress syndrome (RDS) as the major contributors to the neonatal mortality. Adequate antenatal care to the at risk mothers and advances in the neonatal intensive care with the use of sophisticated technology will improve the neonatal outcome.

Key Words: NICU, Neonatal Morbidity, Neonatal Mortality, Rohtas, Bihar

INTRODUCTION

In India alone, of the 25 million babies who are born every year, one million die, accounting for 25% of the mortality around the world. According to the National Family Health Survey - 3 (NFHS-3) report, the current neonatal mortality rate (NMR) in India of 39 per 1,000 live births, accounts for nearly 77% of all the infant deaths (57/1000) and nearly half of the under-five child deaths (74/1000) [1]. The rate of the neonatal mortality varies widely among the different states of India, ranging from 11 per 1000 live births in Kerala to 48 per 1000 live births in Uttar Pradesh. The neonatal mortality rate in Bihar (42 per 1000 live birth) is more than that of the national figure due to the lack of health infrastructures. Preterm birth is one of the major clinical problems in obstetrics and neonatology, as it is associated with increased perinatal mortality and morbidity [2].

The major direct causes of the neonatal deaths were preterm birth, infections, and asphyxia. In a report which was published in The Lancet, the major direct causes of the deaths were pre-term birth (27%), infection (26%), asphyxia (23%), congenital anomalies (7%), others (7%), tetanus(7%) and diarrhoea (3%) [3]. There is only scanty data which is available regarding the neonatal morbidity and mortality patterns in the Indian neonatal intensive care units (NICU) and even if it was there, it would be available mainly from the tertiary care level 3 NICUs in the metropolitan cities [4]. The data from the tertiary care NICUs in the rural areas which primarily serve the very poor people is scarce. To the best of our knowledge, there are hardly any published studies from Bihar which provide the morbidity and mortality patterns in tertiary care NICUs which are located in rural areas, which mainly serve the rural population. The objective of the study was to study the morbidity and mortality patterns in an NICU of a tertiary care teaching hospital which was located in the Rohtas district of Bihar.

MATERIALS AND METHODS

This hospital based retrospective study was carried out in the neonatal intensive care unit (NICU), Department of Pediatrics, at

Narayan Medical College and Hospital (NMCH), Jamuhar, Rohtas, Bihar, India, for a period of 1 year from January 2010 to December 2010. The institutes ethical committee approved the study protocol.

Our hospital caters mainly to rural and semi-urban patients, with a significant number of them being below the poverty line (BPL) income group patients. Approximately 800 deliveries are conducted per year, with a majority of them being conducted on unbooked mothers and mothers with complicated obstetric or antenatal histories, who are referred from district/rural hospitals.

All the admitted neonates were enrolled on a structured protocol, which included the data on antenatal care, maternal morbidity, mode and place of delivery, age, weight at admission, gestational age, diagnosis, relevant investigations, duration of stay and outcome.

Inclusion criteria: All the neonates who were admitted to the NICU belonged to the Rohtas district.

Exclusion Criteria: (a) Neonates who did not belong to the Rohtas district, (b) Babies who left the hospital against medical advice. The calculation of the survival was done after subtracting them from the total admission, as their outcome was not known.

Statistical analysis: The birth weight and the gestational age were expressed in mean ± SD. The data were analyzed by using the Open Epi statistical software, version 2.3.1. The mean, standard deviation, odds ratio and the relative risk were calculated by using appropriate statistical methods. *P* value of < 0.05 was considered to be statistically significant for any given measures.

RESULTS

A total of 285 babies were admitted to our NICU, of which 258 babies belonged to the Rohtas district. Of these 258 babies, 22 babies (who left the hospital against medical advice (LAMA) or were transferred to other hospitals) were excluded from the study. A total of 236 neonates were included for the data analysis. Of these 236 babies, 141 were males and 95 were females. The ratio of the male (59.8%) and female (40.2%) neonates was 1.48: 1. One hundred and fifty three babies (65%) were born in this hospital and 83 (35%) babies were referred from peripheral hospitals and nursing homes. There were 91 (38.6 %) premature deliveries with a mean gestational age of 34.4 ± 3.6 weeks and 94 (39.8 %) LBW neonates with a mean birth weight of 2280 ± 754 gm. The major causes of the morbidity were low birth weight (LBW) (39.8%), prematurity (38.6%), neonatal sepsis (23.3%), neonatal hyperbilirubinaemia (20.4%), birth asphyxia with hypoxic ischaemic encephalopathy (HIE) (18.2 %), intra-uterine growth retardation (IUGR) (14 %) and hyaline membrane disease (9.7 %), as shown in [Table/Fig-1].

The most common causes of the referral from primary health centres and private nursing homes for the out born neonates were severe birth asphyxia with HIE (32.5%), neonatal sepsis (22.9%), prematurity with low birth weight (13.4 %), and prematurity with respiratory distress syndrome (12%) [Table/Fig-2].

In this study, the overall NICU mortality rate was 13.6 % (32/236). There was no statistical significant difference in the outcome between the male and female neonates (p< 0.33), as shown in [Table/Fig-3].

On comparing the survival among the different groups, it was seen that there were significant differences between the VLBW group and the normal birth weight group (p<0.012), and between the ELBW group and the normal birth weight group (p< 0.009). However, there was no statistically significant difference between the LBW group and the normal group (p<0.116) [Table/Fig-4] **.** The relative risk of the deaths in the VLBW and the ELBW groups as compared to the normal birth weight group was 3.9 and 6.5 times respectively.

Morbidity	Preterm (n = 91)	Term (n = 145)	Total (n = 236)
Low birth weight (LBW)	59 (64.8%)	35 (24.1%)	94 (39.8 %)
Neonatal Sepsis	24 (26.4%)	31 (21.4%)	55 (23.3%)
Neonatal Jaundice	21 (23%)	27 (18.6%)	48 (20.4%)
Birth Asphyxia with HIE*	09 (9.9 %)	34 (23.4%)	43 (18.2%)
IUGR@	11 (12.1%)	21 (14.5 %)	33 (14 %)
Hyaline Membrane Disease	21 (23.1%)	02 (1.4%)	23 (9.7%)
Necrotizing Enterocolitis	06 (6.6%)	01 (0.7%)	07 (3%)
MAS**	02 (2.2%)	10 (6.9%)	12 (5.1%)
Congenital Pneumonia	05 (5.5%)	03 (2.1%)	08 (3.4%)
TTN***	09 (9.9%)	04 (2.8%)	13 (5.5%)
Severe Hypothermia	03 (3.3%)	01 (0.7%)	04 (1.7%)
Multiple Congenital anomalies	01 (1.1%)	03 (2.1%)	04 (1.7%)
Others	01 (1.1%)	02 (1.4)	03 (1.3%)

[Table/Fig-1]: Neonatal morbidities at admission#

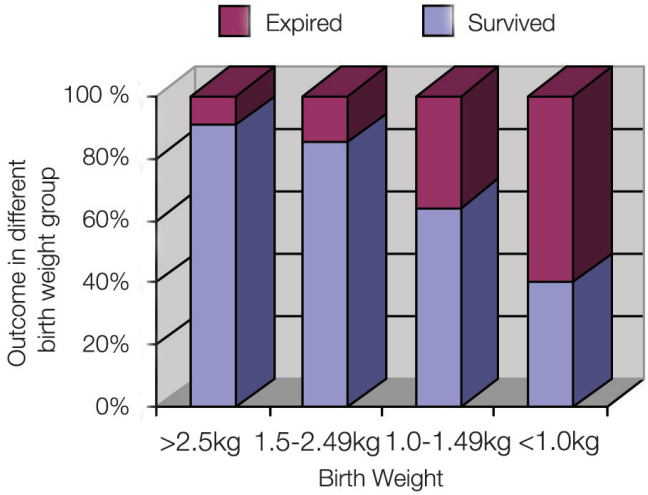
*HIE: Hypoxic Ishaemic Encephalopathy; ** MAS: Meconium Aspiration Syndrome; *** TTN: Transient Tachypnoea of Newborn.@IUGR: Intra Uterine Growth Retardation; # A neonate having more than one morbidity is counted in each category. Hence, the sum may be more than the total neonates in the study population.

Causes for Referral for out born	Proportion of referral N= 83 (%)
Severe Birth Asphyxia + HIE	27 (32.5)
Neonatal Sepsis	19 (22.9)
Prematurity + LBW	11 (13.4)
Prematurity + RDS	10 (12)
Neonatal Jaundice	10 (12)
Others	6 (7.2)

[Table/Fig-2]: Causes of referral for out born neonates

	Male	Female	Total
Admission No (%)	141 (59.8)	95 (40.2)	236 (100)
Death No (%)	18 (56.25)	14 (43.75)	32 (100)
Odds Ratio (95% CI)	0.85 (0.39-1.83)	1.18 (0.55-2.51)	P < 0.33

[Table/Fig-3]: Gender-wise mortality distribution



[Table/Fig-4]: NICU outcome in different birth weight groups

Birth Weight	No of Death (%)
More than 2.5 Kg	13 (40.2)
LBW (1500-2499 gm)	11 (34.8)
VLBW (1000-1499 gm)	5 (15.6)
ELBW (< 1000 gm)	3 (9.4)

[Table/Fig-5]: Showing Birth weight and proportion of Mortality

Morbidity	Sick Neonate No (%)	Death No (%)	Relative Risk of Death (95% CI)	Proportion of Total (%)*
Low birth weight (LBW)	94 (39.8)	19 (20.2)	2.2 (1.1-4.2)	59.2
Prematurity	91 (38.5)	15 (16.5)	1.4 (0.7-2.6)	46.9
Neonatal Septicemia	55 (23.3)	11 (20)	1.7 (0.9-3.3)	34.4
HIE	43 (18.2)	10 (23.2)	2.1 (1.1-3.9)	31.3
Hyaline Membrane Disease	23 (9.8)	8 (34.8)	3.1 (1.6-6.1)	25.0
IUGR	33 (14)	4 (12.1)	0.87 (0.3-2.3)	12.5
Multiple Congenital Anomalies	4 (1.7)	3 (75)	6.0 (3.1-11.6)	9.4
MAS	12 (5)	1 (8.3)	0.6 (0.1-4.0)	3.1
Neonatal Jaundice	48 (20.4)	1 (2.1)	0.1 (0.01-0.9)	3.1

[Table/Fig-6]: Case Fatality and Relative Risk of Deaths associated with selected neonatal morbidities (n = 236, Neonatal death 32).

*A neonate having more than one morbidity is counted in each category. Hence, the sum may be more than the total neonates or deaths in the study population.

Out of the 32 deaths, 13 deaths (40.2% of total deaths) occurred in the normal birth weight group, while 19 deaths [(19/32) 59.9%] occurred in the less than 2.5kg birth weight group [Table/Fig-5]. The outcome of the babies who were born in this hospital (inborn) and of the babies who were referred from other hospitals (out born) was analyzed. Among the inborn babies 9.8% (15/153) expired, while 20.5% (17/83) expired among the out born babies. The difference in the mortality rate was significant (odds ratio 2.37 95% CI 1.11- 5.03), (p = 0.0135).

The case fatality and relative risk of the deaths which were associated with the morbidities were calculated as shown in [Table/Fig-6].

DISCUSSION

Accurate data on the morbidity and mortality are useful for many reasons. It is important for the providers of primary care, investigators, local and national health administrators, and for decision makers to design interventions for prevention and treatment and to implement and evaluate health care programs. The data from hospitals in the smaller cities and from the NICUs of low resource settings is very limited. In smaller cities, the number of NICUs are less and the number of level 3 NICUs are even lesser and there are very few published reports from these hospitals [5].

In our study, the the admissions of male babies were more than those of females. These may be related to the preference for the male child in the society and the biological vulnerability of the males to infection. The male preponderance for admissions has been documented in previous studies [6].

In our study, 40% of the neonates were low birth weight (LBW) and 39% neonates were delivered prematurely. This may be due to the poor maternal health status, poor antenatal check up and the poor socio-economic status of the families, because our hospital predominantly catered to the rural population with very high degree of unemployment and poverty. Similar findings were reported in earlier studies from other developing countries with a poor socioeconomic status. In a hospital based study, the incidence of the premature deliveries was 16.3% [7]. According to the UNICEF "The State of the World's Children 2010" report, 28% neonates are born with low birth weight in India [8].

In this study, the other common morbidities were neonatal sepsis (23.3%), neonatal jaundice (20.4%), birth asphyxia with hypoxic ischaemic encephalopathy (HIE) (18.2 %), intrauterine growth retardation (IUGR) (14 %) and hyaline membrane disease (9.7 %).

Neonatal sepsis was the most important cause of morbidity and mortality, especially among the LBW and the preterm babies in the developing countries. According to the National Neonatal Perinatal Database (2002-03), the incidence of neonatal sepsis in India was 30 per 1000 live-births. The database which comprised 18 tertiary care neonatal units across India, found sepsis to be one of the commonest causes of neonatal mortality, which contributed to 19% of all the neonatal deaths [4].

Neonatal jaundice was the most common problem amongst the neonates. In our study, 20.4 % of the newborns (18.6% term neonates and 23 % preterm neonates) had jaundice. In a study from Pakistan, an overall home based surveillance detected that the rate of hyperbilirubinaemia (bilirubin >5 mg⁄ dl) among 1690 newborns was 39.7⁄1000 live births (95% CI 29.3–47.6) and that 27.6% were referred for treatment to hospitals [9]. In our study, the lower prevalence could be attributed to the poor nutrition status of mother and the poor antenatal services.

Birth asphyxia is an important cause of neonatal morbidity and mortality. The incidence of moderate to severe grade birth asphyxia with HIE was observed in 18.2 % (43/243) neonates in the present study, which is similar to the finding of Chandra et al [10].

In this study, the commonest causes of death were LBW (59.2%), prematurity (46.9%), neonatal sepsis (34.4%), HIE (31.3%) and respiratory distress syndrome (25%). In contrast, in an ICMR study, prematurity (16.8%), birth asphyxia (22.3%) and infections which included septicaemia, pneumonia, meningitis and other infections (32.8%) were found to be the predominant causes of death [11]. In a study at JIPMER, systemic infections were found to cause 52.3% of the deaths, followed by birth asphyxia and injuries (29.23%) [12]. But, the present study reiterates the point that the high proportion of the deaths which were attributed to LBW and prematurity may be due to poor antenatal care, poor nutritional status of the pregnant women, especially in the rural areas, the poor health infrastructure, and delayed referral from peripheral hospitals.

Low birth weight (LBW) deaths accounted for 59 % of the total deaths in our study. In a study from a sub-district level hospital from India, Kumar et al reported a similar mortality rate [13]. Our study also showed that preterm babies with a birth weight which was less than 1500g were strongly associated with high mortality. Yasmin et al from Bangladesh also reported that VLBW and lower gestational age (<32weeks) carried a high mortality risk [14].

The neonatal mortality in babies who were delivered at NMCH, Jamuhar was only 9.8% as compared to 20.5% in babies who

were referred from other hospitals. Neonates who were referred From other hospitals (outborn) had 2.5 times higher mortality than those who were born in our hospital (inborn). The better outcome in the babies who were born at NMCH was most likely due to the timely perinatal interventions at the tertiary care level and the early availability of effective neonatal intensive care.

In the developing countries, neonatal sepsis and HIE are the major causes for hospitalization in the NICU and they dominate as the major causes of death. In our study, neonatal sepsis and HIE accounted for 34.4% and 31.3 % of the neonatal deaths respectively. The neonates with severe birth asphyxia had two times more mortality than those who had no asphyxia. Rashid et al from Bangladesh (developing country) reported a similar outcome [15]. Garg et al, from a community level NICU, have reported birth asphyxia as the leading cause of death, followed by sepsis [16]. There is a broad agreement that in infants with more than 2500 g of birth weight, the death is influenced by the obstetric management and that in those who are LBW, it was the quality of the neonatal care that had an important bearing on the outcome. With the present study having identified LBW, prematurity, neonatal sepsis and HIE as the major causes of death, there is a need for further developments in obstetric and neonatological units for better antenatal (obstetric) and intensive neonatal care with the use of more sophisticated technology.

CONCLUSION

This study identified LBW, prematurity, neonatal sepsis, neonatal hyperbilirubinaemia, and HIE as the major causes of morbidity and low birth weight, prematurity, neonatal sepsis, HIE, and Hyaline membrane disease or Respiratory distress syndrome (RDS) as the major contributors to neonatal mortality. With LBW and prematurity being the commonest contributors of death, attempts to prolong the pregnancy each week might improve the neonatal outcome considerably. This study has some limitations. As it was a hospital based study and as most of the patients had a low socio-economic status, the results of this study may not reflect the true burden which is prevalent in the community as a whole.

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Contributors: MKK and SNT were involved in conception, collection of data and in drafting of the manuscript. MKK, SNT and BBS were involved in analyzing the data and critical revision of the manuscript. MKK will act as guarantor for the article.

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